Some Useful Facts

Resistor & Ohm’s Law
\[ v = Ri \text{ or } i = Gv, \quad G = \frac{1}{R} \]

Voltage Source
Voltage \( v_s \) is known.
Current is unknown.

Current Source
Current \( i_s \) is known.
Voltage is unknown.

Power & the Passive Sign Convention [PSC]

Power into a device [or absorbed by the device]:
\[ p_{in} = vi \]
[using the passive sign convention]

Power to a resistor:
\[ P_R = v_i = i^2R = \frac{v^2}{R} \]

Power out of a device [or delivered by the device]:
\[ p_{out} = vi \]
[not using the passive sign convention]

Kirchhoff’s Laws

KVL: algebraic sum of voltages around a loop equals zero; or sum of all voltage drops around a loop equals zero.

KCL: algebraic sum of currents at a node equals zero; or sum of all currents leaving a node equals zero.

Series & Parallel Combinations

Voltage sources:
in series: add the voltage waveforms
in parallel: the voltages must be the same

Current sources:
in parallel: add the current waveforms
in series: the currents must be the same

ADD resistances in SERIES
\[ R_{eq} = \sum_{i=1}^{k} R_i = R_1 + R_2 + \cdots + R_k \]

ADD conductances in PARALL
\[ G_{eq} = \sum_{i=1}^{k} G_i = G_1 + G_2 + \cdots + G_k \]

Voltage divider
\[ v_j = iR_j = \left( \frac{R_j}{R_{eq}} \right) v \]

Current divider
\[ i_j = \frac{v}{R_j} = \left( \frac{R_{eq}}{R_j} \right) i \]
\[ v = \frac{dw}{dq}; \quad i = \frac{dq}{dt} \]